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Forthcoming Articles

Among the articles scheduled to appear in this magazine are the following:

- Is Mobile Learning the Future of 21st Century Education? Educational Considerations from Various Perspectives
- Revisiting Cognitive Tools: Shifting the Focus to Tools-in-Use.
- Sustaining Research Innovations in Educational Technology Through Communities of Practice.

In addition to our regular article, several special issues are now in preparation for publication later this year and in 2013.

Using Citation Network Analysis in Educational Technology

Yonjoo Cho
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Previous reviews in the field of Educational Technology (ET) have revealed some publication patterns according to authors, institutions, and affiliations. However, those previous reviews focused only on the rankings of individual authors and institutions, and did not provide qualitative details on relations and networks of scholars and scholarly works. This insufficient landscape of the field has led the authors to become interested in discovering the relational patterns and network attributes in the scholarly works through a citation network analysis. The purpose of the study reported in this article was to introduce a citation network analysis in ET to promote interdisciplinary collaboration with neighboring fields. The distinctive features of citation network analysis derive from the utilization of a social network analysis approach to examining relational and network attributes in the citation data. The comparison of the citation network analysis of ET to that of human performance technology (HPT) and human resource development (HRD) fields are discussed and implications are elaborated for future research.

Introduction

A way to define an academic field is to examine research published by the academic community because scholarly publication is "an expression of the state of a group of

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scholars at a particular time" (de Sola Price, 1970, p. 6; Kirby, Hoadley, & Carr-Chellman, 2005). In this context, social science disciplines have produced extensive reviews of the literature to assess their current state and envision the future, using content analysis (e.g., Furrer, Thomas, & Goussevskaia, 2008) and citation analysis (e.g., Ramos-Rodríguez & Ruiz-Navaro, 2004). Recently, citation frequency and networks based on social network analysis have revealed the scholarly influence among academic publications (e.g., Fernandez-Alles & Ramos-Rodríguez, 2009).

Reviews of Educational Technology

When it comes to the field of Educational Technology (ET), we can find several reviews of its scholarly works using content analysis (Klein, 1997), productivity analysis (Hannafin, 1991; Ku, 2009), and citation analysis (Anglin & Towers, 1992; Gall, Ku, Gurney, Tseng, Yeh, & Chen, 2010; Kirby *et al.*, 2005; Zaugg, Amado, Small, & West, 2011).

Using content analysis of articles in *Educational Technology Research and Development (ETR&D)* articles, Klein (1997) generated rankings of article topics, types of articles, and first authors. Major findings of this study indicated: (1) almost half of all articles published were descriptions about a specific program, and (2) performance technology was among the preferred topics, which had not received enough attention in the journal.

Two reviews (Hannafin, 1991; Ku, 2009) have dealt with scholarly productivity in the field. Hannafin (1991) identified leading ET journals (e.g., *ETR&D* and *Educational Technology*) and scholarly productivity by academic rank and affiliation. In a similar vein, Ku (2009) identified the top 20 most productive institutions and authors in the field through a productivity scoring analysis. Although these authors provided quantitative information about scholarly productivity, they did not detail key research themes and relations among scholars.

In comparison to content and productivity analyses, citation analysis is quantitative analysis of the literature produced by a field and the relationships among people as evidenced by whom they cite in their published articles (Kirby *et al.*, 2005). Anglin and Towers (1992) identified 37 ET scholars who were frequently cited in the *ECTJ* and *JID* journals (former journals of *ETR&D*), whereas Gall and colleagues (2010) generated a list of nine journals that are most cited by *ETR&D* and frequently cite it. In contrast, Kirby *et al.* (2005) provided a citation analysis of publications (journals and proceedings) in the fields of Instructional Systems Design and Learning Sciences to examine to what degree the two fields are integrated. The authors revealed that the two fields are generally isolated from each other but that there is growing interest in bridging the existing chasm.

Most recently, citation analysis using Google Scholar has been used to examine ET research with the help of the *Publish or Perish* (PoP) software. Randall, Bishop, Alexander, and West (2011) examined *The Journal of the Learning Sciences (JLS)* published between 2001 and 2010, while Zaugg and colleagues (2011) did this with *ETR&D*) in the same timeframe. In *JLS*, the science- and mathematics-related topics had the most frequent counts (e.g., Cobb *et al.*, 2001), whereas in *ETR&D*, articles concerning instructional design were the most frequently cited (e.g., Merrill, 2002). However, the problem is that PoP does not always provide completely accurate publication counts, because it depends solely on the search results of Google Scholar. The worth of citations counted by Google Scholar, as the authors (Randall *et al.*, 2011; Zaugg *et al.*, 2011) have indicated, may be debatable and not completely comprehensive, while many citation counts continue to fluctuate. In addition, PoP does not identify the author name variants (Baneyx, 2008; Jacsó, 2009).

Previous reviews have revealed some publication patterns according to authors, institutions, and affiliations. However, those previous reviews focused only on the rankings of individual authors and institutions, and their focus on individual papers has obscured the larger patterns in the citation data (Howard, 2011). In addition, they did not provide qualitative details on relations and networks of scholars and scholarly works that could stimulate meaningful discussions in the ET scholarly community. This insufficient landscape of the field has led us to become interested in discovering the relational patterns and network attributes in the scholarly works through a citation network analysis.

What Is Citation Network Analysis?

Citation network analysis is an answer to solve the limitations of previous reviews because connections in scholars and scholarly works matter. A distinctive feature of citation network analysis is that it has a theoretical framework borrowed from social network analysis (Jo, Jeung, Park, & Yoon, 2009). Barnes (1954) used the term social network for the first time to describe the connections among people in his anthropological study (Knoke & Yang, 2008). Social network analysis is a methodology for examining structures among actors, groups, and organizations, with some patterns of interaction or ties between them (Borgatti, Mehra, Brass, & Labianca, 2009; Hatala, 2006). For example, Christakis and Fowler's (2007) study of obesity using social network analysis is well-known for its longitudinal, quantitative analysis of large amounts of obesity data repeatedly assessed in the past 30 years. Major findings were that network phenomena appear to be relevant to the biological and behavioral traits of obesity, and obesity appears to spread through social ties.

The first study using citation network analysis was Garfield and his colleagues' (1964) research on the history of DNA in which they analyzed citation patterns in authors and articles (Calero-Medina & Noyons, 2008). Citation network analysis shows the influence and role of

specific journals, articles, or authors in the network through illustrating the citation network as a whole (Pieters, Baumgartner, Vermunt, & Bijmolt, 1999). Citation network analysis is a useful technique to analyze the interplay among articles and a method for examining networks of citations between published works as well as to track the flow of ideas and how the flow of ideas changes over time in the field (Jeung, Yoon, Park, & Jo, 2011; Rosvall & Bergstrom, 2010).

Analysis of a citation network built among publications allows us to have a better grasp of how a scholarly community has evolved in the field (Jo *et al.*, 2009). Citation network analysis has been used in diverse fields, including biology (Rosvall & Bergstrom, 2010), communication (Barnett, Huh, Kim, & Park, 2011), human resource management (Fernandez-Alles & Ramos-Rodríguez, 2009), human resource development (Jeung *et al.*, 2011; Jo *et al.*, 2009), and human performance technology (Cho, Jo, Park, Kang, & Chen, 2011). For example, Rosvall and Bergstrom (2010) analyzed the citation pattern of about 7000 scientific journals over the past decade and found that neuroscience has developed from an interdisciplinary field into a more mature and stand-alone field, like molecular biology or medicine, comparable to physics, chemistry, economics or law.

The Use of Citation Network Analysis for Interdisciplinary Collaboration

Exploring other disciplines is important to inspire new ideas and clarify areas in terms of reflecting on the discipline (Kozma, 2000). ET has a great advantage in such interdisciplinary collaboration, because theoretical diversity has advanced the field (Haynes & Cho, in press). Citation network analysis can be a tool for interdisciplinary collaboration in ET. Recently, Cho and colleagues (accepted) identified the five key themes of ET by analyzing the citation network of 803 articles published in *ETR&D* from 1989 to 2011. These key five themes of ET were compared to those of HPT (identified by a citation network of *Performance Improvement Quarterly*) (Cho *et al.*, 2011) and those of HRD (discovered through a citation network analysis of four HRD journals) (Jo *et al.*, 2009) (see ***Table 1***).

The results of thematic analysis in Cho *et al.*'s (accepted) study are in contrast with those of HRD discovered by Jo *et al.*'s (2009) citation network analysis. While the themes of HRD (e.g., theory building) are more theoretical and distant from immediate practical needs than those of ET, it appears that the ET field is a more narrowly focused field than HRD. Instructional design (ID), however, has been recognized as an important intervention for planning processes, and the practice of HRD and has also played a critical role in the instructional nature of the field (Hardré, 2003; Korth, 1997). For example, ID is critical when designing blended training for transfer into the workplace (Lee, 2010); ID also provides important implications to HRD professionals when involved in distance education (Woodall, 2004).

Table 1. Comparison of key research themes of ET, HPT, and HRD.

ET	HPT	HRD
• Instructional Design • Learning Environments • The Role of Technology • IT Research • Psychological Foundations	• Performance • Instructional Design • Performance Support • Organization/ Workplace • Transfer of Training	• Learning and Performance • Theory Building • Training Transfer

ID was also among the five key themes in the HPT field, indicating that ET and HPT are closely related (Cho *et al.*, 2011). The two fields, however, had different emphases in ID research. The ET field has produced studies on conceptual frameworks (e.g., Jonassen & Rohrer-Murphy, 1999), instructional design models (e.g., Jonassen, 1997), and designing learning environments (e.g., Hannafin, Hannafin, Land, & Oliver, 1997), whereas HPT's studies have emphasized instructional designers' practices and activities from the lens of experts and novices (e.g., Rowland, 1992) and increasing efficiencies of ID in different contexts (e.g., van Rooij, 2010). This is presumably due to each field's emphasis on theory or practice and because HPT claims to be a "field of practice" (Foshay, Moller, Shwen, Kalman, & Haney, 1999, p. 896).

In Cho *et al.*'s (accepted) study, the five key themes identified from the *ETR&D* network were less distinctive and, rather, inter-related in direct or indirect ways. One possible reason is that conceptual frameworks in ET research were mostly borrowed from psychology (Weinstein & Shuck, 2011). Although the ET field has always claimed to have an interdisciplinary nature that is influenced by diverse fields, such as psychology, communication, systems, and management (Ely, 2008), Cho *et al.* (accepted) did not identify evidences of the field's interdisciplinary efforts for expanding the scope of ET research, except with psychology.

As the unit of analysis in ET research becomes larger and it becomes more complex to investigate learning environments in diverse organizational settings, multiple perspectives and innovative approaches to ET research are called for in the field. Theory development efforts as in HRD, therefore, will help advance the field by providing more explanatory power and insights to existing ET research. For example, Hardré (2003), through an extensive review of existing models and methods of ID and HPT, calls for a new model of motivation for ID that is current, comprehensive, integrative, and flexible to meet the demands of a new HRD paradigm.

Conclusion

The use of citation network analysis has expanded the limited landscape of ET. Identifying whose scholarly works are the most influential and what relationships are the most impactful in the field is definitely a timely intellectual discourse that we need to possess in order to make the scholarly community strong and sustainable, as well as to expand our interdisciplinary efforts to advance the field. We feel a strong need to break boundaries to broaden our analytic perspective towards convergence among neighboring fields. Based on previous citation network analyses, it is time to propose an interdisciplinary and integrative network analysis at a wider level. □

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Educational Technology Research Journals

Journal of Technology and Teacher Education, 2001–2010

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In this study, the authors examined the *Journal of Technology and Teacher Education* to determine research trends from the past decade (2001–2010). Topical (via EBSCO subject term analysis), article types, and authorship trends were all analyzed. A few of *JTATE*'s seminal articles were also identified using *Publish or Perish*. Findings were then compared to the stated aims and scope of the journal. The analysis revealed the journal has had a strong emphasis on teaching methods, teacher attitudes, distance education, and professional development, in addition to educational technology and preservice teacher education. Interpretative and design-based research studies have been most common, and collaborative authorship is an increasing trend.

Introduction

The *Journal of Technology and Teacher Education (JTATE)* is the official scholarly, peer-reviewed journal of the Society for Information Technology and Teacher Education (SITE), which is the only international organization focused solely on the integration of technology in teacher education programs (Society for Information Technology and Teacher Education, n.d.). *JTATE* is also an official publication of the Association for the Advancement of Computing in Education (AACE), which is closely affiliated with SITE. Founded in 1981, AACE is an international, non-profit educational organization whose mission is to advance "information